APPLICATION NUMBER 10/671,218 EXHIBIT B

EPON Topologies

As Figure 2 shows, EPON is typically deployed as a tree or tree-and-branch topology, using passive 1:N optical splitters.

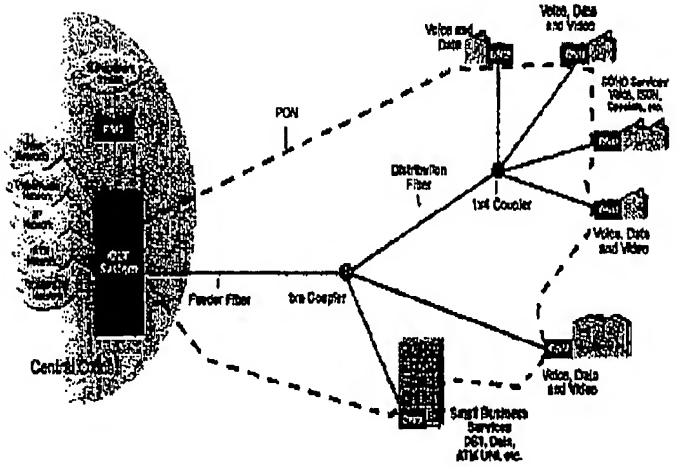

Figure 2: EPON System Architecture

EPON Network

An EPON network includes an *optical line terminal* (OLT) and an *optical network unit* (ONU).

The OLT resides in the CO (POP or local exchange). This would typically be an Ethernet switch or Media Converter platform.

The ONU resides at or near the customer premise. It can be located at the subscriber residence, in a building, or on the curb outside. The ONU typically has an 802.3ah WAN interface, and an 802.3 subscriber interface.

In Figure 3, the OLT is on the left and several ONUs are shown on the right

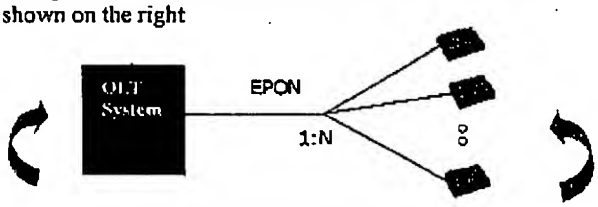

Figure 3:ONU and OLT

EPON Systems

EPON is configured in full duplex mode (no CSMA/CD) in a single fiber point-to-multipoint (P2MP) topology. Subscribers, or ONUs, see traffic only from the headend; each subscriber cannot see traffic transmitted by other subscribers, and peer-to-peer communication is done through the headend, or OLT.. As Figure 4 shows, the headend allows only one subscriber at a time to transmit using a Time Division Multiplex Access (TDMA) protocol

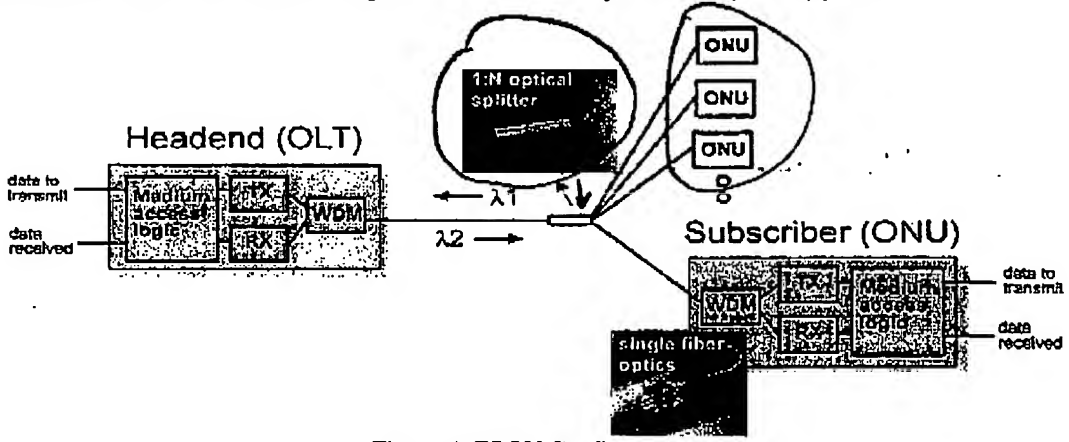

Figure 4: EPON Configuration

EPON systems use an optical splitter architecture, multiplexing signals with different wavelengths for downstream and upstream as such:

- 1490 nm downstream
- 1310 nm upstream

Though configured as point to multipoint, Ethernet PON can be deployed in an Ethernet access platform, with both point-to-point and point-to-multipoint access cards, as shown in Figure 5.

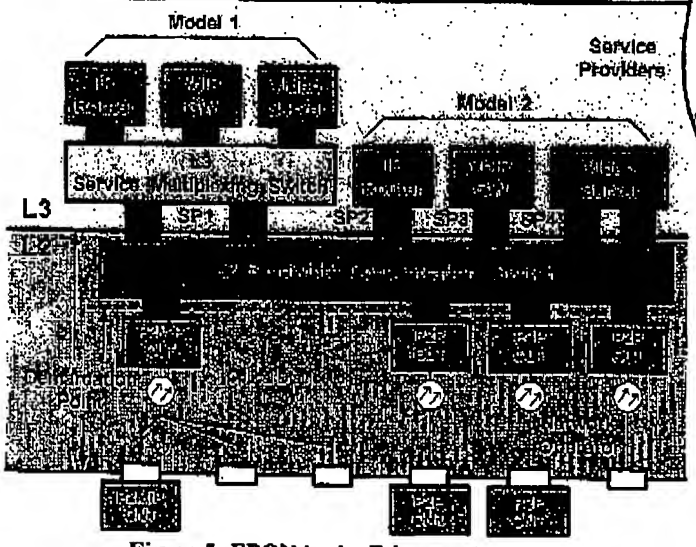

Figure 5: EPON in the Ethernet Access Model

EPON Protocol

To control the P2MP fiber network, EPON uses the Multi-Point Control Protocol (MPCP).

MPCP performs bandwidth assignment, bandwidth polling, auto-discovery, and ranging. It is implemented in the MAC Layer, introducing new 64-byte control messages:

- GATE and REPORT are used to assign and request bandwidth
- REGISTER is used to control the auto-discovery process

MPCP provides hooks for network resource optimization. Ranging is performed to reduce slack, and bandwidth reporting satisfies requirements by ONUs for DBA. Optical parameters are negotiated to optimize performance.

ONU and OLT Operation

The ONU performs an auto-discovery process which includes ranging and the assignment of both Logical Link IDs and bandwidth. Using timestamps on the downstream GATE MAC Control Message, the ONU synchronizes to the OLT timing. It receives the GATE message and transmits within the permitted time period.

The OLT generates time stamped messages to be used as global time reference. It generates discovery windows for new ONUs, and controls the registration process. The OLT also assigns bandwidth and performs ranging operations.

EPON Downstream

Downstream, EPON handles the physical broadcast of 802.3 frames. As Figure 6 shows, broadcast frames are extracted by the logical link ID in the preamble. 64-byte GATE messages are sent downstream to assign upstream bandwidth.

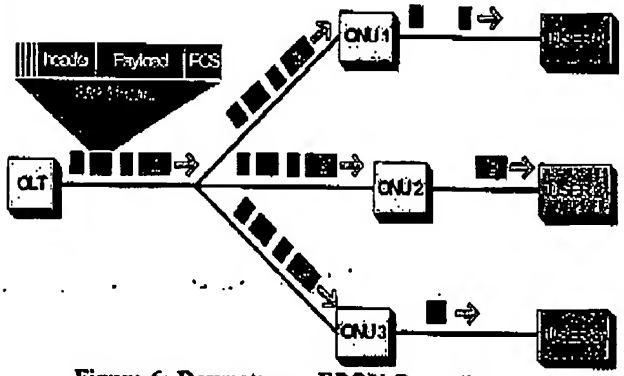

Figure 6: Downstream EPON Operation

More detail on the 64-byte GATE message is shown in Figure 7.